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Research article

CT findings and analysis for misdiagnosis of female pelvic tuberculosis

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Abstract

Purpose: To analyze the computed tomography (CT) findings and the reasons for misdiagnosis of female pelvic tuberculosis.
Methods: The clinical and CT features of 32 cases of female pelvic tuberculosis identified over a five-year period (2010–2015) were retrospectively analyzed. The CT features were analyzed for nature, range and extent of the various pathological patterns.
Results: Because of the non-specific clinical and CT features, 20 of 32 cases were misdiagnosed either as ovarian tumor, or chocolate cyst, or PID preoperatively and received surgery. The mean age of the patients was 29.97 years (age range 15–67 years). Elevated levels of serum CA125 were found in 29 patients (90.62%, 29/32). The CT findings were as follows: 1. Pelvic mass (87.5%, 28/32): unilateral adnexal mass was in 15 cases, bilateral in 13 cases, 8 masses were cystic, 10 were solid, 23 were mixed, 24 masses showed multilocular caseous necrotic enhancement; 2. Ascites (40.62%, 13/32): 8 of 13 cases showed high density ascites (CT value > 18 HU); 3. Thickening and enhancement of peritoneum (37.5%, 12/32): nodulously thickened in 7 cases, smoothly in 5 cases; 4. Adhesion in the abdominopelvic cavity (28.12%, 9/32); 5. Lymphadenopathy (21.87%, 7/32): calcified in 4 cases, low attenuation necrotic lymph nodes with ring enhancement in 2 cases; 6. Thickening and enhancement of bowel wall (15.62%, 5/32).
Conclusions: Integrated with clinical history and laboratory tests, pelvic tuberculosis should be considered in young female patients with elevated CA125 and CT findings of adnexal mixed (solid and cystic) mass with multilocular caseous necrotic enhancement, high density ascites, thickened and enhanced peritoneum. Early diagnosis of the disease is a key consideration for early institution of anti-TB therapy to avoid misdiagnosis and surgical explorations.

Keywords: Pelvic tuberculosis; Computed tomography; Pelvic mass; Ascites; CA125

1. Introduction

Tuberculosis (TB) is a chronic infectious disease caused by *Mycobacterium tuberculosis* (MTB). In recent years, it has emerged as a major public health problem in developing and underdeveloped countries. The incidence of TB is increasing due to emergence of human immunodeficiency virus (HIV) infection, multidrug resistant strains of the microbes, and poor socioeconomics [1]. TB usually attacks the lungs, but it may also attack other organs, such as kidneys, bone, central

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nervous system (CNS), gastrointestinal tract (GIT), female genital tract, peritoneum, etc. Extrapulmonary TB accounts for 15–20% [2] of all cases of TB, of which abdominal TB accounts for 11–16% [3], and pelvic TB accounts for 5.7% [4].

Female pelvic TB is a relatively rare type of extrapulmonary TB, and only few literatures have been reported till date. Owing to its rarity, the CT findings of female pelvic TB have not been fully described and are easy to be misdiagnosed as advanced ovarian malignancy (AOM) or pelvic inflammatory disease (PID) without pathological findings. The interpretation of CT findings and differentiation from AOM, which can metastasize, are clinically important. Recognition and understanding the spectrum of CT findings of female pelvic TB can aid in the diagnosis. In this study, we retrospectively reviewed the clinical and CT features of 32 cases of female pelvic TB in an effort to avoid misdiagnosis and surgical explorations.

2. Materials and methods

2.1. Patients

We retrospectively analyzed the clinical and CT features of 32 cases of female pelvic TB, identified over a five-year period (2010–2015) in three institutions. The institutional review board of hospitals approved the study and did not require additional informed patient consent for reviewing the patient's medical records and images. We also reviewed English-language literature on pelvic tuberculosis based on PubMed records.

2.2. CT protocol

The CT examinations were performed in all patients either with a 64-MDCT scanner (GE Medical Systems LightSpeed VCT, Milwaukee, WI, USA) or with a 128-MDCT scanner (SIEMENS SOMATOM Definition Flash). The CT scanning parameters were as follows: for 64 detector rows, a beam collimation of 64 × 0.625 mm, a pitch of 0.984, 5 mm slice thickness, and 5 mm reconstruction intervals; for 128 detector rows, a beam collimation of 128 × 0.6 mm, a pitch of 1.2, 5 mm slice thickness, and 5 mm reconstruction intervals. Unenhanced CT and contrast-enhanced CT scans were performed during a single breathhold with patients in a supine position. All patients received intravenous contrast material (90 mL) as a bolus at the rate of 3 mL/s, and the CT images were obtained during arterial, portal venous, and delayed phases at 30, 60, and 180 s after contrast material injection, respectively.

2.3. CT evaluation

The CT images were retrospectively evaluated by consensus of two experienced radiologists who were unaware of the final diagnosis of the patients on a local picture archiving and communication system (PACS) monitor. The CT features were analyzed with regard to the presence or absence and characterization of pelvic mass, such as nature (solid, cystic or mixed), contour (round, ovoid, lobulated or tubular), margin (well-defined or ill-defined), enhancement pattern (multilocular caseous necrotic enhancement, homogeneous or heterogeneous, progressive or not); and presence or absence of calcification. The CT features were also evaluated for presence or absence of ascites, thickening and enhancement of parietal, mesenteric and omental peritoneum, adhesion in the abdominopelvic cavity, lymphadenopathy, thickening and enhancement of bowel wall. The CT images of chest were also evaluated for any lung abnormality.

2.4. Laboratory tests

Laboratory tests of blood included complete blood counts (CBC), erythrocyte sedimentation rate (ESR), c-reactive protein (CRP), routine biochemistry analysis, serum CA125. Abdominal fluid analyses included ascites fast bacilli smear, ascites culture, polymerase chain reaction (PCR). Mantoux test or purified protein derivative (PPD) skin test was also performed in some patients. Diagnostic procedure in 20 patients included laparotomy and laparoscopy.

3. Results

3.1. Clinical features

The mean age of the patients was 29.97 years (age range 15–67 years). Twenty two patients came from countryside and ten were living in cities. Menstrual cycles were regular in all patients except menopause in one, secondary amenorrhea in four, oligomenorrhea in five with infertility in four. Clinical presentations were abdominal pain (n = 16), abdominal distension (n = 8), cough (n = 8), fever with night sweat (n = 7), weight loss (n = 7). Past medical history was insignificant in all patients, except one whose grandfather had a history of pulmonary TB. On physical examination, four patients had positive shifting dullness in the abdomen and pelvic mass was also seen in some cases.

3.2. CT findings

The CT findings of female pelvic TB for all patients are summarized in Table 1. The CT findings were as follows:

1. Pelvic mass (87.5%, 28/32) (Table 2): unilateral adnexal mass was in 15 cases and bilateral in 13 cases (total 41 masses); 23 masses were mixed (Solid & cystic) (Figs. 1 and 2), 10 masses were solid (Fig. 3), 8 were cystic. Calcification was found in 11 masses (Fig. 4). The shape of the mass was found to be round (n = 13), ovoid (n = 12), lobular (n = 15), or tubular (n = 1). The margin was ill-defined in 21 masses and well-defined in the remaining masses. Multilocular caseous necrotic enhancement was seen in 24 masses (Figs. 1 and 2). The enhancement patterns were homogeneous in 8 masses (Fig. 3) and heterogeneous in 9 masses (Fig. 4). The CT value of the plain scans ranged from 20 to 39 Hounsfield

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Table 1
CT findings of the female pelvic tuberculosis.

Case	Age	Pelvic mass	Ascites	Thickened and enhanced peritoneum	Adhesion in the abdominopelvic cavity	Lymph adenopathy	Thickened & enhanced bowel wall
1	22	+	−	−	−	−	−
2	18	+	+	+	−	+	−
3	67	+	+	−	+	−	−
4	46	+	+	−	−	−	−
5	29	+	+	+	−	−	+
6	43	+	+	+	−	+	−
7	22	+	−	−	−	+	−
8	18	+	+	+	−	−	−
9	30	+	−	−	+	+	+
10	26	+	+	+	+	−	+
11	45	+	+	+	−	−	−
12	27	+	−	−	−	−	−
13	29	+	−	−	−	+	−
14	38	+	−	−	−	−	−
15	43	+	−	−	−	−	−
16	27	+	−	−	−	−	−
17	25	+	−	−	−	−	−
18	20	+	−	−	+	−	−
19	25	+	−	−	−	−	−
20	26	+	−	−	−	−	−
21	27	+	−	+	+	+	−
22	39	+	−	−	−	−	−
23	39	+	−	−	−	−	−
24	25	+	−	−	−	−	−
25	25	+	−	−	−	−	−
26	15	+	+	+	−	−	−
27	34	+	−	−	−	−	−
28	25	+	−	−	−	−	−
29	17	−	+	+	+	−	−
30	21	−	+	+	+	+	+
31	24	−	+	+	+	−	+
32	42	−	+	+	+	−	−

'+' = Present; '−' = absent.

units (HU, mean 34 HU), arterial phase with a CT value of 22−58 HU (mean 48 HU), venous phase with a CT value of 24−81 HU (mean 74.25 HU), and delayed phase with a CT value of 20−94 HU (mean 82 HU) in all pelvic masses demonstrating progressive enhancement pattern.

2. Ascites (40.62%, 13/32): 8 of 13 cases showed high density ascites (CT value > 18 HU) (Figs. 1 and 2);
3. Thickening and enhancement of parietal, mesenteric and omental peritoneum (37.5%, 12/32): nodulously thickened in 7 cases (Fig. 1), smoothly in 5 cases (Fig. 2);
4. Adhesion in the abdominopelvic cavity (28.12%, 9/32);
5. Lymphadenopathy (21.87%, 7/32): calcified in 4 cases, low attenuation necrotic lymph nodes with ring enhancement in 2 cases;
6. Thickening and enhancement of bowel wall (15.62%, 5/32).

One patient who had a coexisting teratoma with pelvic TB presented as a heterogeneous mass (5.0 × 2.5 cm) with a focal nodular shadow of fat density (CT value of about −72HU) and calcification (Fig. 2D). Abnormal chest CT scan was found in 8 cases (25%, 8/32) including two patients with both pleural effusion and pleural thickening, two with only pleural effusion, two with fibrocalcific lesions, one with cavitary lesions and one with bilateral upper lobe tuberculoma. In our study, due to non-specific clinical and CT features 20 cases were misdiagnosed either as ovarian tumor, or chocolate cyst, or PID preoperatively and received surgery.

3.3. Laboratory findings

CBC showed increased white blood count (WBC) with neutrophil predominance in 10 cases. Elevated ESR in 16 and CRP in 7 cases. Elevated levels of serum CA125 (range 156.1−676.1 IU/ml) were found in 29 patients (90.62%, 29/32). Only six patient's PPD skin tests were positive. Ascites fast bacilli smear and culture were positive in 8 ascitic patients. Ascitic fluid cytology didn't show any malignant cells. PCR test reported positive in four cases for TB infection.

3.4. Diagnostic procedure and pathological findings

The diagnosis was established by operative biopsy and histopathology in 20 (62.5%) patients, including laparotomy (n = 12, 37.5%), laparoscopy (n = 8, 25%); by combination of clinical, laboratory, and CT findings in 12 patients. The intra-

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Table 2
CT characterization of pelvic mass.

Case	Location	Nature	Contour	Margin	Calcification	Enhancement pattern
1	LA	Mixed	Ovoid	Well-defined	−	MCNE
2	RA	Mixed	Lobulated	Ill-defined	−	MCNE
	LA	Mixed	Ovoid	Well-defined	−	MCNE
3	RA	Solid	Ovoid	Well-defined	−	Homogeneous
4	LA	Mixed	Tubular	Well-defined	−	Heterogeneous
5	RA	Mixed	Ovoid	Ill-defined	−	MCNE
	LA (Teratoma)	Mixed	Ovoid	Well-defined	−	Heterogeneous
6	RA	Mixed	Lobulated	Ill-defined	−	MCNE
	LA	Mixed	Lobulated	Ill-defined	−	MCNE
7	LA	Mixed	Lobulated	Ill-defined	+	Heterogeneous
8	RA	Solid	Ovoid	Well-defined	−	Homogeneous
	LA	Solid	Ovoid	Well-defined	−	Homogeneous
9	RA	Solid	Round	Well-defined	−	Homogeneous
	LA	Mixed	Ovoid	Well-defined	+	Heterogeneous
10	RA	Mixed	Ovoid	Well-defined	−	MCNE
	LA	Mixed	Round	Ill-defined	−	MCNE
11	RA	Mixed	Round	Ill-defined	−	MCNE
	LA	Cystic	Round	Well-defined	−	MCNE
12	RA	Solid	Round	Ill-defined	+	Homogeneous
	LA	Solid	Lobulated	Ill-defined	+	Homogeneous
13	RA	Cystic	Round	Well-defined	+	MCNE
	LA	Solid	Ovoid	Ill-defined	+	Heterogeneous
14	LA	Solid	Round	Well-defined	−	Homogeneous
15	LA	Mixed	Ovoid	Well-defined	−	MCNE
16	LA	Mixed	Lobulated	Ill-defined	−	Heterogeneous
17	RA	Mixed	Lobulated	Ill-defined	−	MCNE
18	RA	Cystic	Lobulated	Ill-defined	−	MCNE
	LA	Cystic	Lobulated	Ill-defined	−	MCNE
19	RA	Mixed	Round	Well-defined	+	Heterogeneous
20	RA	Mixed	Lobulated	Ill-defined	+	Heterogeneous
	LA	Cystic	Round	Well-defined	+	MCNE
21	RA	Mixed	Lobulated	Ill-defined	−	MCNE
	LA	Mixed	Round	Well-defined	−	MCNE
22	LA	Cystic	Round	Well-defined	+	MCNE
23	LA	Mixed	Lobulated	Ill-defined	−	MCNE
24	RA	Mixed	Lobulated	Ill-defined	−	MCNE
	LA	Mixed	Round	Ill-defined	−	MCNE
25	LA	Cystic	Ovoid	Well-defined	−	MCNE
26	RA	Cystic	Lobulated	Ill-defined	−	MCNE
27	LA	Solid	Lobulated	Well-defined	+	Heterogeneous
28	RA	Solid	Round	Well-defined	−	Homogeneous

RA = right adnexa; LA = left adnexa; MCNE = multilocular caseous necrotic enhancement.
'+' = Present; '−' = absent.

operative findings revealed adnexal mass in 20 patients, ascites in 5 patients, nodulously thickened parietal, mesenteric and omental peritoneum in 5 cases, matted gut and dense adhesions in 4 cases. Histopathological examination of frozen sections of tissue biopsies showed tuberculoid-type granulomatous inflammatory reactions in 20 patients. All patients were treated with anti-TB therapy (Isoniazid, rifampicin, ethambutol, pyrazinamide, streptomycin) and remained well after a complete course of treatment.

4. Discussion

Tuberculosis (TB) is a pulmonary and systemic disease caused by *M. tuberculosis* (MTB), an aerobic bacillus. It is a major worldwide public health problem. Approximately 33% of the world population is infected with the tubercle bacillus, and 2 million people die each year of TB [5]. The rising incidence is due to increasing susceptibility and antibiotic resistance. The susceptible groups include immunocompromised, elderly, alcoholics and poor socioeconomics. TB predominantly affects the lungs but spread via lymphatics and blood vessels allows dissemination to other organs, such as kidneys, bone, central nervous system (CNS), gastrointestinal tract (GIT), female genital tract, peritoneum, etc.

Female pelvic TB, an uncommon gynecological problem, is frequently reported to occur following primary pulmonary TB [6]. Pelvic TB is usually confined to fallopian tube (95–100%), endometrium (50–60%) and ovary (20–30%) [7,8]. It frequently affects reproductive age group women and is common in developing and undeveloped countries. Our study showed the mean age of the patients was 29.97 years (age range 15–67 years), which is earlier than that reported in

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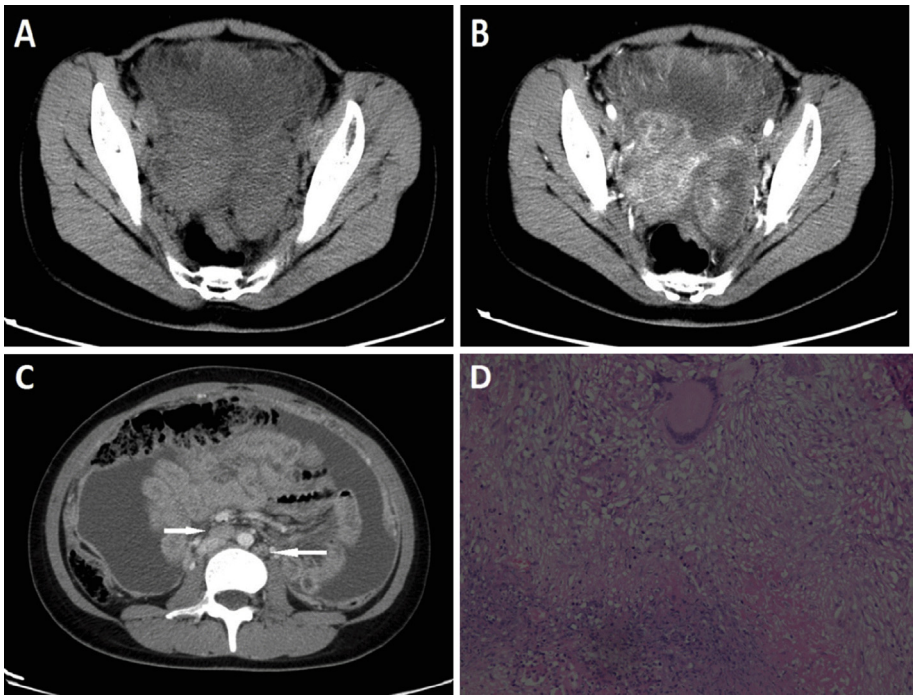

Fig. 1. A 18-year-old female with pelvic tuberculosis. Non-enhanced CT scan of the abdomen and pelvis shows bilateral adnexal mixed (solid and cystic) masses measuring 5.7 × 3.3 cm (right) and 7.3 × 3.3 cm (left) (A). Contrast-enhanced CT scan shows multilocular caseous necrotic enhancement in arterial phase (B). Venous phase showing high density ascites, nodulously thickened and enhanced peritoneum and enlarged lymph nodes (arrows) (C). Histopathological study revealed tuberculoid-type granulomatous inflammatory reactions (H&E stain, ×200) (D).

advanced ovarian malignancy (AOM); 22 patients came from countryside. It indicates that despite its occurrence at any age, young females with poor socioeconomics were mostly affected.

Pelvic TB may manifest itself asymptomatically, however typically presents with a low-grade fever, malaise, abdominal pain, infertility and menstrual disturbances [9]. In our series, the most common clinical presentations were abdominal pain,

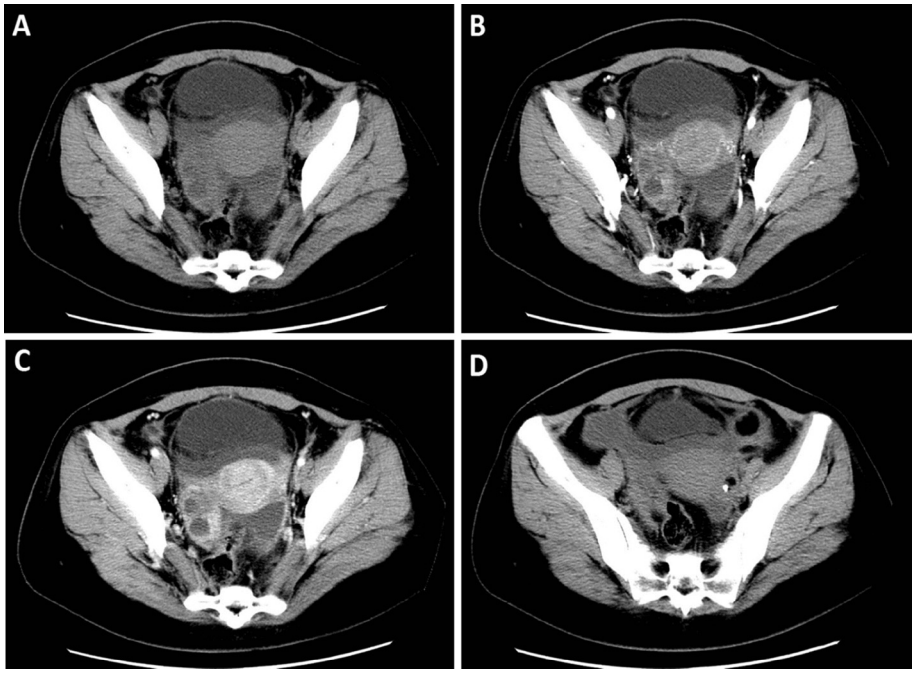

Fig. 2. A 29-year-old female with pelvic tuberculosis. Non-enhanced CT scan of the abdomen and pelvis shows an ovoid, ill-defined, mixed (solid and cystic) mass arising from the right adnexa measuring 4.3 × 3.4 cm (A). Contrast-enhanced CT scan shows multilocular caseous necrotic enhancement in arterial phase (B), and venous phase (C). Left adnexal mass (5.0 × 2.5 cm) with a focal nodular shadow of fat density (CT value of about −72HU) and calcification (D). This patient also showed high density ascites, smoothly thickened and enhanced peritoneum.

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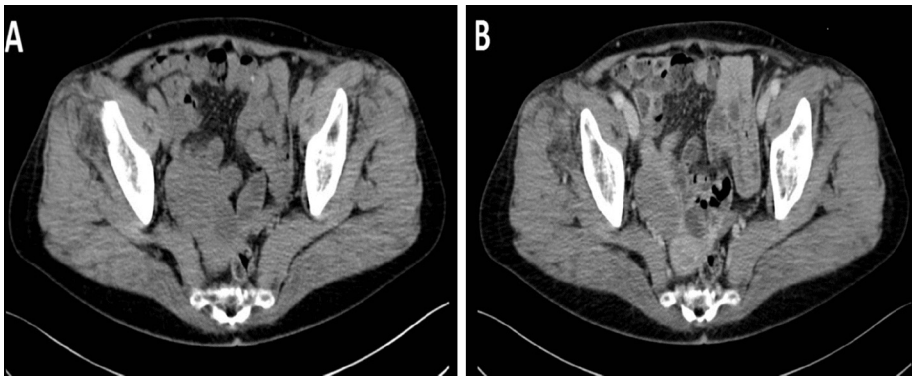

Fig. 3. A 67-year-old female with pelvic tuberculosis. Non-enhanced CT scan of the abdomen and pelvis shows an ovoid, well-defined, solid mass arising from the right adnexa measuring 5.1 × 2.8 cm (A). Contrast-enhanced CT scan showing homogeneous enhancement in delayed phase (B).

Fig. 4. A 22-year-old female with pelvic tuberculosis. Non-enhanced CT scan of the abdomen and pelvis shows a lobulated, ill-defined, left adnexal mixed (solid and cystic) mass with calcification within it (A). Contrast-enhanced CT scan shows heterogeneous enhancement (B).

abdominal distension, cough, fever with night sweat, weight loss and menstrual cycles were regular in all patients except menopause in one, secondary amenorrhea in four, oligomenorrhea in five with infertility in four. On physical examination, the most common signs were pelvic mass and ascites.

CT is the imaging modality of choice for pelvic TB. The most common CT findings in our series were adnexal mixed (solid & cystic) mass with multilocular caseous necrotic enhancement, high density ascites, thickened and enhanced peritoneum. Lymphadenopathy with low density in the center revealed in up to 40% of other studies [10,11], occurred in only two of our seven patients with adenopathy. The low density centers were attributed to caseation necrosis in TB, which were occasionally found in metastatically seeded nodes. Coexisting teratoma and TB of uterine adnexa may change the clinical and imaging features, leading to difficulty in diagnosis, as seen in our 5th case. Chest CT scan also plays an important role in the diagnosis of pelvic TB. Abnormal chest CT scan was found in 8 cases (25%, 8/32) of our series. Liu Qi et al. [12] showed 53.57% of their women with abnormal chest CT scan. Radiologically, it is difficult to distinguish pelvic TB from AOM and PID due to overlapping imaging features. Pelvic mass, ascites, thickened and enhanced peritoneum, omental involvements are also suggestive of AOM and PID. Magnetic resonance imaging (MRI), positron emission tomography (PET) and Ultrasonography (USG) have all been used to evaluate female pelvic TB, but the features are non-specific for pelvic TB.

The preoperative differential diagnosis of female pelvic TB mainly includes AOM and PID. In a postmenopausal woman with adnexal mass, ascites and raised CA125 typically point to a diagnosis of AOM. Most of our patients presented with pelvic mass, ascites and elevated serum CA125 level. In our series, twelve cases were misdiagnosed as ovarian tumor or chocolate cyst or PID preoperatively and received surgery. CA125 is a non-specific marker of ovarian cancer and can be raised in a variety of conditions including pelvic infections, TB, endometriosis, fibroids, Meige's syndrome, peritonitis, menstruation, ovarian hyperstimulation, pancreatitis and hepatitis [13,14]. In our study, CA125 was elevated in 29 patients (90.62%, 29/32). Normalization of the CA125 level has associated with the response to anti-TB therapy in various series [15,16]. Yassaee F et al. [17] reported that it is rare for pelvic TB to present clinically with very high serum CA125 (>1000 U/ml). Similar findings were found in our study with elevated levels of serum CA125 (range 156.1–676.1 IU/ml). An adnexal mass with very high serum CA125 may lead to the diagnosis of an ovarian carcinoma [18]. However, pelvic TB with a very high serum CA125 is also reported in the literature [19].

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Mantoux test or purified protein derivative (PPD) skin test is a screening test and has a false positive or negative result. The significance of recently introduced interferon gamma release assay is debatable in countries with a high prevalence of TB [20,21]. Ascitic fluid mycobacterium bacilli are difficult to detect by smear or culture because of the paucibacillary nature of the intra-abdominal disease. Polymerase chain reaction (PCR) has limited sensitivity in detecting MTB because of the problems with the preparation of specimens. Definitive diagnosis of pelvic TB is mainly established on the basis of histopathological examination. Analysis of frozen sections of tissue biopsies typically shows inflammatory infiltrates and focal epithelioid cell granulomas with presence of acid-fast bacilli. Our series also showed tuberculoid-type granulomatous inflammatory reactions. In our study, because of the non-specific clinical presentations, CT findings and a mixed bag of bacteriological and serological tests, 20 out of 32 cases were misdiagnosed either as ovarian tumor, or chocolate cyst, or PID preoperatively and received surgery. The diagnostic procedure in 20 (62.5%) patients included laparotomy and laparoscopy. The common intra-operative findings were adnexal mass, ascites, nodulously thickened parietal, mesenteric and omental peritoneum, matted gut and dense adhesions in the abdominopelvic cavity. By combination of clinical, laboratory, and CT findings; the diagnosis of pelvic TB was established in 12 patients.

The diagnostic criteria of female pelvic TB are based on clinical history, laboratory tests, radiological findings and histopathology. Early diagnosis of the disease is a key consideration for early institution of anti-TB therapy to avoid misdiagnosis and surgical explorations. The anti-TB therapy regimens include isoniazid, rifampicin, ethambutol, pyrazinamide, streptomycin. All patients in our study were treated with anti-TB therapy and remained well after a complete course of treatment.

There were some limitations to our study that should be mentioned. Firstly, our study was performed retrospectively. Secondly, a small number of patients were included because of the rarity of pelvic TB. A further limitation is that our study did not differentiate the CT findings of pelvic TB to other pelvic malignancy. In the future, these limitations will be needed to better understand features of pelvic TB.

5. Conclusions

Unlike pulmonary TB, the diagnosis of pelvic TB is difficult because of the non-specific clinical presentations, imaging findings and a mixed bag of bacteriological and serological tests. Integrated with clinical history and laboratory tests, pelvic tuberculosis should be considered in young females with poor socioeconomics having slightly elevated CA125 and CT findings of adnexal mixed (solid and cystic) mass with multilocular caseous necrotic enhancement, high density ascites, thickened and enhanced peritoneum. Chest CT scan is also helpful to aid in the diagnosis. Preoperative diagnosis of pelvic TB is of paramount importance to avoid misdiagnosis and surgical explorations.

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